

SOURCE CREDIBILITY AND SIMILARITY OF SELF-GENERATED AND
EXTERNALLY-PROVIDED ANCHORS PREDICTS FINAL RESPONSES:
A METACOGNITIVE PERSPECTIVE OF THE ANCHORING HEURISTIC

By

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The present research examined the hypothesis that in addition to self-generated anchors (SGAs), source credibility and the similarity between SGAs and externally-provided anchors (EPA) influence anchoring through metacognitive processing. Participants were asked to respond to two trivia questions and were required to express their initial estimates (i.e., SGAs) before being presented with values supplied by the environment (i.e., EPAs). The EPAs were manipulated to reflect either high or low similarity with participants' SGAs. Participants were also led to believe that the EPAs derived from either a high or low credible source. Consistent with the hypotheses, high source credibility and similarity between participants' SGAs and the EPAs led to overall stronger anchoring effects and greater confidence in final responses. The data suggest that SGA-EPA similarity and source credibility work to influence the anchoring and adjustment heuristic through metacognitive means.

INTRODUCTION

People often estimate unknown quantities and make numeric judgments that have no immediately discernable points of reference. For example, estimating the value of real estate or approximating the number of points a stock may increase when buying and selling on the stock market are just a few examples of the many judgments that often necessitate quick estimates about magnitudes in which the actual answer is unknown. One manner in which uncertain quantities may be estimated is to start with information that is made accessible by the environment and to then adjust away from this information until an acceptable final response is reached. This is the reasoning behind the anchoring and adjustment heuristic, which refers to the adjustment of an assessment about an unknown quantity, based upon previously presented external information, otherwise known as an “anchor” (Tversky & Kahneman, 1974). This estimation strategy is readily apparent in the assimilation of a numeric final response to an anchor (Mussweiler & Strack, 1999). The typical finding from anchoring research is that people tend to insufficiently adjust their final responses away from anchors provided by the environment.

Over three decades of research have demonstrated the anchoring heuristic to be a prevalent force on human judgment and decision making. This heuristic has been found to reliably influence judgments across a wide variety of domains, including preference reversals (Chapman & Johnson, 2002), legal judgments (Chapman & Bornstein, 1996), probability estimates (Plous, 1989; Tversky & Kahneman, 1974), negotiation (Neale & Bazerman, 1991; Ritov, 1996), and general knowledge (Chapman & Johnson, 1999;

Jacowitz & Kahneman, 1995; Wilson, Houston, Etling, & Brekke, 1996). Furthermore, the anchoring and adjustment effect appears to be viable across many situations for both novices and experts (Northcraft & Neale, 1987) and effective under conditions of monetary incentives (Chapman & Johnson, 1999; Wilson, Houston, Etling, & Brekke, 1996). The anchoring effect has also been found to reliably occur in a varied assortment of settings, including the laboratory (Jacowitz & Kahneman, 1995), in the field (Mussweiler & Strack, 2004), and within the classroom (Plous, 1989). The anchoring and adjustment heuristic thus appears to be a very robust psychological phenomenon. However, while researchers have given considerable attention to the anchoring effect over the past several decades, details pertaining to the cognitive processes that may govern the operation of this common source of inaccuracy in everyday numerical judgments are still unclear (see Chapman & Johnson, 2002 for a review).

The current research was designed to offer insight into these processes by describing and testing a process account of the anchoring and adjustment heuristic. Specifically, this perspective assumes that when people form estimates of unknown quantities they first generate an implicit range of plausible values that becomes part of the context for their subsequent judgments. Evidence in support of the notion that an plausible, implicit range emerge when people are first asked to estimate an unknown quantity is demonstrated by the overwhelming data that indicate a strong tendency for people to correctly make upward adjustments from low anchors and downward adjustments from high anchors (Chapman & Johnson, 2002; Jacowitz & Kahneman, 1995; Tversky & Kahneman, 1974). That is, people seem to be quite accurate in knowing whether an anchor is too high or too low and this seems to imply that an

implicit, plausible range of values is activated. This knowledge is also likely to act much like a standard of comparison for their consequent judgments. For example, when considering the number of people living in Chicago, most people seem to know that the actual population is at least greater than 1,000 citizens and subsequently report final responses larger than this value. Likewise, given that people would be unlikely to respond “zero” or “infinite” if asked “How many books have been written about George Washington?”, it appears that people incorporate an implicit range of values when generating answers to such questions.

It is proposed that these initial thoughts can be affected, via a metacognitive mechanism, by an external anchor which is provided by the environment. In other words, judgments about this initial range of values are reevaluated in light of the anchor and moderated by the metacognitive mechanism that compares and integrates this initial thought and the external anchor into a final response. According to this perspective, insufficient adjustment away from the anchor may result from thoughts about one’s initial thought (i.e., metacognition), which are shaped by the similarity between the initial thought about the anchoring item being estimated and the information provided by the environment (i.e., the anchor). This possibility is directly examined in the current study.

The Anchoring and Adjustment Heuristic

The anchoring and adjustment heuristic made its initial appearance in a seminal study conducted by Tversky and Kahneman (1974) where they demonstrated the anchoring and adjustment effect using a paradigm that included two sequential questions. Specifically, the first question in this series required participants to determine whether a judgmental target was more or less than some comparison numerical value, such as

whether the number of African nations in the United Nations was more or less than 65% (the high anchor condition) or 10% (the low anchor condition). This question is typically referred to as a *comparative assessment* and the numerical value contained within it (e.g., 65% or 10%) as the *externally-provided anchor* (e.g., EPA). Following the comparative assessment, the second question in this series requested participants to provide their final response for the same judgmental target; that is, a final estimate approximating the number of African nations belonging to the United Nations. In the example described above, Tversky and Kahneman found that the median estimates of the absolute percentages of African nations in the United Nations were 45% in the high anchor condition and 25% in the low anchor condition. This finding suggests that participants' final responses were substantially influenced by the EPA. In fact, this assimilative pattern towards the EPA is the hallmark of the “modern” anchoring effect (Tversky & Kahneman, 1974). It is important to note that the typical finding of insufficient adjustment away from the EPA occurred even when participants were informed that the EPAs were uninformative and had no implications for the actual answer to the question. In fact, in many carefully constructed versions of this paradigm, participants are explicitly shown that the EPAs provided within the comparative assessment are randomly selected by spinning a “wheel of fortune” prior to their judging the comparative assessment.

After the publication of Tversky and Kahneman's (1974) classic findings on the anchoring and adjustment effect, research on this heuristic rapidly burgeoned as experimenters attempted to study the effect across a diverse range of varied contexts. Over the last 30 years, many studies have time and again demonstrated that the anchoring

effect is a truly robust psychological phenomenon which has been reliably found to occur in a variety of different settings (Jacowitz & Kahneman, 1995; Mussweiler & Strack, 2004; Plous, 1989). For instance, in one of the most widely cited anchoring studies, Northcraft and Neale (1987) investigated the elicitation of the anchoring heuristic in a real-world setting by pitting college students against real estate agents in a task that required each group to estimate the prices of real estate properties. Participants were given access to ostensibly valid listing prices to assist in their estimation about the financial value of the real estate properties. However, the researchers manipulated these prices in such a way that participants received values that were either greatly above or below the true retail price of the properties. The results from this study indicated that these listing prices (i.e., the EPAs) markedly influenced the final responses of both the college students and the real estate agents. That is, both the “experts” and novices showed evidence of insufficient adjustment in the direction of an EPA.

Inconsistencies within the Anchoring Literature

Despite the advances of three decades of active research, the anchoring and adjustment literature is littered with contradictions and inconsistencies. Experimental manipulations that should influence the amount of effortful adjustment away from the EPA, such as financial incentives and advanced forewarnings that describe the assimilative nature of the anchoring heuristic, seem to have little to no effect on final responses given in response to the traditional anchoring paradigm (Chapman & Johnson, 2002; Janiszewski & Uy, 2008). Furthermore, empirical investigation of the underlying process governing the process underlying the anchoring and adjustment has been unclear

despite a substantial amount of research having been conducted to uncover the situational pressures that elicit the anchoring effect.

In their original study, Tversky and Kahneman (1974) observed that participants' final responses tended to be characterized by insufficient adjustment because their final judgments were unmistakably biased in the direction of the EPA. However, they were unable to identify a cognitive mechanism that may lead to chronically insufficient adjustments away from the EPA. Other researchers (Miller, Galanter, & Pribram, 1960; Quattrone, 1982; Quattrone, Lawrence, Finkel, & Andrus, 1981) who have proposed process explanations for the anchoring and adjustment effect have either improperly tested their hypotheses or have failed to provide convincing evidence. For example, one account (Quattrone, 1982) proposed that a lack of motivation or ability to engage in effortful cognitive processing is the cause of insufficient adjustment away from the EPA and suggests that the remedy to cure this inaccuracy in estimation is to offer participants an incentive to increase effortful processing. However, as the anchoring studies (Chapman & Johnson, 2002; Janiszewski & Uy, 2008) cited earlier demonstrated, neither forewarnings about the influence of anchors on numerical judgments nor financial incentives for increased accuracy appear to reduce the anchoring and adjustment effect. Another account (see Chapman & Johnson, 2002) suggests that people engage in a "satisficing" procedure whereby they adjust until they reach the nearest edge of an implicit range of plausible estimates. From this perspective, insufficient adjustment occurs because the actual answers to the anchoring items only rarely correspond to this outer boundary of estimates (Quattrone et al., 1981). Unfortunately, this "satisficing" process account for the anchoring heuristic has never been tested directly for its

predictive validity (Chapman & Johnson, 2002). Finally, Miller et al. (1960) proposed that the anchoring heuristic operates in a cybernetic fashion whereby people adjust from an EPA and test whether the adjusted value is plausible. If this value is deemed plausible, then this value serves as their final response for the anchoring item being considered. However, if it is not, then additional adjustment occurs and this new adjusted value is again tested for its plausibility. This process is repeated until a feasible final response is reached. Thus, according to this account, people tend to continue to adjust until they render a final response that is within the anchor side of a range of values. While this account offers an intriguing explanation for the process that governs anchoring and adjustment, it has never been examined empirically. Despite their differences, however, one commonality uniting all of these disparate accounts is that they all suggest that the processes governing the anchoring heuristic are automatic.

Recently, contention has emerged among researchers (Epley & Gilovich, 2001, 2004, 2006; Mussweiler & Strack, 1999, 2000, 2001; Strack & Mussweiler, 1997) over the issue of whether Tversky and Kahneman's (1974) classic anchoring paradigm actually evidences adjustment in the first place. A recent body of extensive work (Mussweiler & Strack, 1999, 2000, 2001; Strack & Mussweiler, 1997), which attempted to identify the cognitive mechanism that gives rise to adjustment in the standard anchoring paradigm, has yielded little evidence in support of the existence of true serial adjustment. This research suggests that responses to the typical anchoring paradigm are not the result of adjustment but rather due exclusively to a semantic priming mechanism. In a series of studies, Strack and Mussweiler (1997) provided evidence for the notion that people compare the given target to an EPA and positively test the hypothesis that the

target in question is identical to the value of the EPA when subjected to the traditional anchoring paradigm. According to their selective knowledge activation mechanism (SA) model, participants tend to assimilate their final responses to previously activated EPA-biased target knowledge, which results in semantic priming. Specifically, when people make comparative assessments (e.g., “Was Mohammad born before or after 800 AD?”), the SA model posits that people assess whether the EPA is the correct answer to the item before adjusting away from the EPA. Previous research investigating hypothesis testing has found that people typically evaluate hypotheses by seeking confirmatory evidence in favor of the hypothesis being tested (Klayman & Ha, 1987). This search for confirmatory evidence in favor of the EPA as the actual answer to the anchoring item under consideration leads to a disproportionate activation of information consistent with the EPA, which subsequently becomes highly accessible as people construct their final responses. The high accessibility of this information causes participants’ final responses to be biased in the direction of the EPA, a finding which is traditionally considered evidence of insufficient adjustment. However, similar to Strack and Mussweiler (1997), Epley and Gilovich (2006) reported that final responses of this nature given within the classic anchoring paradigm appear to provide little or no information about the processes involved in anchoring and adjustment. These researchers estimated that the effects reported by earlier demonstrations of insufficient adjustment were the result of priming mechanisms rather than actual anchoring effects.

The Importance of Self-Generated Anchors

While the classic anchoring paradigm may have failed to provide evidence for the existence of true adjustment, reliable evidence for adjustment outside of the traditional

paradigm has emerged. Building on Strack and Mussweiler's (1997) findings, Epley and Gilovich (2001, 2005, 2006) argued that *self-generated anchors* (i.e., SGAs) rather than EPAs demonstrate actual adjustment. Specifically, SGAs refer to internal anchors that people generate themselves as approximate estimates when constructing their final response to an anchoring item. People's SGAs tend to be close to the actual answer but often need modification (similar to EPAs). For example, when people are asked to estimate the year that George Washington was elected President of the United States, most Americans are aware that he was elected after the Declaration of Independence (i.e., 1776), but how long after this date? Similar to EPAs, SGAs are anchors that serve as starting points in estimating the solutions to anchoring items where the correct answer is unknown. However, they are an internal source of information. Epley and Gilovich proposed that anchors of this nature do not need to be evaluated as potential answers (unlike EPAs) in the traditional paradigm, which effectively circumvents the activation of mechanisms of selective accessibility. Their research suggests that people are aware that their SGAs are not the correct answer from the very beginning of the anchoring and adjustment process, and they adjust from these values until a plausible final response is reached.

Evidence supporting the notion that modification of SGAs demonstrates actual adjustment comes from two lines of research (Epley & Gilovich, 2002, 2004, 2005). One body of work consists of verbal protocols where participants were asked to articulate their thoughts as they generated an SGA and adjusted it either upwards or downwards to estimate a series of anchoring items. Findings from this string of studies suggest that people engage in a conscious process of anchoring and adjustment when considering

SGAs but not when considering EPAs in the classic anchoring paradigm (Epley & Gilovich, 2001). In the second line of research, participants' willingness to accept estimates early in the anchoring and adjustment process was directly manipulated when judging SGAs and EPAs. For instance, one experiment required participants to either nod their heads up and down in acceptance or shake their head left to right in disagreement while simultaneously considering either an EPA or a SGA. The researchers found that participants supplied final responses closer to SGAs (e.g., they adjusted less) when engaged in acceptance behaviors (i.e., nodding their heads) than when engaged in disagreement behaviors (i.e., shaking their heads). In contrast, this manipulation did not influence final responses when participants were assessing EPAs presented within the traditional anchoring paradigm (Epley & Gilovich, 2004, 2005). This finding is especially significant because it provides evidence that procedures known to increase cognitive load influence final responses made when participants consider SGAs, but not when judging the correctness of EPAs, a manipulation that was originally suggested to influence final responses made in the classic anchoring task that were found not to have any effect (Chapman & Johnson, 2002). Additional support for the importance of SGAs in the anchoring and adjustment process comes from studies which have found that adjustments from SGAs are increased by incentives for accuracy, and warnings about the assimilative nature of anchoring effects appears to increase adjustment away from SGAs (Epley & Gilovich, 2005). However, these manipulations were found to not have any effect on adjustment from EPAs.

When taken together, the findings from Epley and Gilovich's studies (2001, 2004, 2005, 2006) make a clear statement about the importance of SGAs to the process

underlying the anchoring and adjustment heuristic. Specifically, they suggest that the generation of SGAs when estimating unknown targets activates processes of adjustment that lead people to insufficiently adjust away from these anchors. On the other hand, these studies also suggest that EPAs initiate a procedure that on the surface appears to involve mental adjustment but in reality is something more akin to semantic priming. Ultimately, across both types of anchors, it appears that people anchor onto a value they either self-generate (i.e., SGAs) or that is provided to them by the environment (i.e., EPAs), but the specific processes activated by each anchor when rendering final responses about an unknown quantity differs between internal and external anchors. This recent proposal is a significant development for anchoring research because previously only EPAs were given empirical attention for the role they play in the operation of the anchoring and adjustment effect. Also, the results reported from these studies suggest that, when people consider SGAs, anchoring and adjustment is a conscious and deliberate process. Now that SGAs have been recognized to play an important role in the operation of the anchoring effect, future research can begin to investigate how their interaction with EPAs and other contextual factors influences people's final responses to anchoring items. In addition, while previous theorizing about the processes governing the anchoring effect has taken the perspective that the anchoring heuristic operates in an automatic fashion (Miller et al., 1960; Quattrone, 1982; Quattrone et al., 1981), this research suggests that anchoring and adjustment is a conscious and deliberate process where people give consideration to both their SGA and the EPA.

However, despite the advancements Epley and Gilovich's (2001, 2004, 2005, 2006) studies have provided to the present understanding about the anchoring heuristic,

they have three significant limitations. First, these studies (and all recent research exploring the anchoring effect) did not propose and test an actual process account that explains the operation of the anchoring and adjustment heuristic. While they provided evidence that SGAs are important to the anchoring process and operate in a fashion that is different from EPAs, they failed to outline a process that describes the mental steps that people take from the initial moment of generating an SGA to using this anchor to render a final response about an anchoring item under consideration. In concert with this first limitation, their studies also did not take into account the interaction that exists between SGAs and EPAs. When people are required to form final responses about unknown quantities, it is likely that they incorporate multiple factors into their judgments, including the information provided by both anchors in the environment and anchors that are generated internally. A viable process account for the anchoring and adjustment heuristic should take into account the influence both types of anchors have on people's final responses. In fact, some previous research has suggested that people do in fact use the unique information from both internal and external anchors when rendering final responses to anchoring items (Chapman & Johnson, 2002). Finally, a third limitation of these studies is that they did not directly measure participants' SGAs. Without such a direct assessment, it is impossible to observe the interaction between their SGAs and the EPA for any given anchoring item. Given the evidence that people may use both types of anchors when constructing final responses (Chapman & Johnson, 2002), it is necessary to understand their interaction to fully comprehend the process underlying the anchoring and adjustment heuristic.

Metacognitive Aspects of Judgment

One of the primary goals of the present research is to test a metacognitive account of the anchoring and adjustment heuristic, which may help to explain the cognitive process governing this heuristic. Metacognition refers to people's thoughts about their own or others' thoughts and thought processes (Jost, Kruglanski, & Nelson, 1998; Petty, Briñol, & Tormala, 2002). The notion that people are able to assess and evaluate their own thoughts and cognitions when forming judgments has received considerable attention across several psychological domains. For example, research on attitudes has demonstrated that people are able to consciously perceive and reflected on their resistance to persuasion. This ability to perceive and reflect on their attitudes has been found to allow for inferences to be made that affect attitude certainty (Tormala & Petty, 2004). Another example of the importance of metacognitive phenomena on judgments comes from the domain of human memory. Here, research has found that the degree of the strength of feelings people are able recall about an obscure name predicts the length of time they spend searching for that name within memory before giving up (Costermans, Lories, & Ansay, 1992).

Despite the pervasiveness of metacognition to explain a diverse range of social phenomenon (see Jost et al., 1998), it has yet to be considered as a factor important to the cognitive processes underlying the anchoring and adjustment heuristic. Earlier research on the anchoring and adjustment effect suggests that metacognition may play an important role within this process. For example, Epley and Gilovich (2006) reported findings showing that participants were able to verbally articulate the anchoring and adjustment process when they considered SGAs to render final responses about

anchoring items. This articulation process would require that people be able think about their thoughts and the cognitive processes involved in the anchoring and adjustment process. Furthermore, research demonstrating that incentives for accuracy and warnings about the nature of the anchoring effect increased people's adjustment away from their SGAs (Epley & Gilovich, 2006) suggests that people are actively thinking about the various factors and cognitive processes involved with the anchoring effect, such as the information received from the environment and their own initial estimates. Therefore, in accordance with recent theorizing about the anchoring and adjustment heuristic and the role metacognition may play in everyday human judgments, the current research proposes that the similarity between people's SGAs and EPAs serves as unique metacognitive information that people consciously think about and actively use to determine how much they should adjust away from the EPA in order to reach a plausible final response.

A Metacognitive Perspective of Anchoring and Adjustment

In this research, it is assumed that when people make estimates about anchoring items where they have little prior information available to inform their judgments, they rely on anchors provided by the environment, just as previous research on the anchoring and adjustment effect has shown. It is also assumed that the consideration of an anchoring item causes people to spontaneously generate an internal anchor (i.e., SGA), which is consciously accessible for further processing. Furthermore, the value of this internal anchor is typically considered not to be the correct answer for the item under consideration but is thought to be close to the true answer. A metacognitive perspective of anchoring and adjustment holds that once the SGA is activated, people may infer from the EPA the degree of correctness of their SGA. That is, they actively compare their

SGA against the EPA in order to determine the plausibility of the SGA as the correct answer for the anchoring item under consideration. By definition, this process is considered metacognitive.

According to this account, the specific comparison people invoke between their SGA and the EPA is the degree of similarity between these two anchors. Specifically, when their SGA is similar to the EPA, people may infer from the relatively small SGA-EPA similarity difference that their SGA may be reasonable, and perhaps even the correct answer for the anchoring item under consideration, which subsequently causes them to fail to sufficiently adjust away from the EPA as reflected in their final responses. However, when their SGA is very different from the EPA, people may infer from the relatively large SGA-EPA similarity difference that the EPA may be unreasonable and incorrect. In this latter case, when SGA-EPA similarity is low, people's final responses may still be influenced by the EPA, but these responses are likely to be marked by more sufficient adjustment away from the EPA than when their SGA is very similar to the EPA. If this reasoning is true, then it should be possible to demonstrate that SGA-EPA similarity predicts the amount of anchoring in the traditional anchoring paradigm.

One view of the degree of SGA-EPA similarity is that it serves as an indicator of the degree of consensus that may exist for any given SGA and EPA. Also, it is important to note that this account of the anchoring and adjustment effect is theorized to be a metacognitive process that occurs within people's awareness; that is, people actively think about and consciously deliberate on both their internal and external anchors when comparing them against one another to determine their degree of similarity.

In addition to SGA-EPA similarity, the proposed process account for the anchoring and adjustment heuristic also posits that other metacognitive factors should influence people's final responses to anchoring items. One such factor is the credibility of the source that anchor information derived from the environment originates from. In the case of anchors, a source can be defined as credible if people perceive the source to have or offer significant knowledge about the topic being described by the EPA under consideration. For instance, an automobile mechanic would likely be thought of as a credible source if people were considering the accuracy of an EPA whose value described how many miles a car should travel before requiring a necessary oil change. In contrast, an EPA that derived from a real estate agent would not likely be considered very credible in this case. Thus, according to the proposed metacognitive account, people should anchor more strongly onto EPAs that are believed to have come from highly credible sources than EPAs that are thought to have derived from sources which are perceived to have low credibility for the anchoring item under consideration.

Taken together, the similarity between people's SGAs and EPAs, as well as other metacognitive factors, such as source credibility, act to influence final responses given when making judgments about anchoring items. It is important to note, however, that the proposed account argues that SGA-EPA similarity is the primary mechanism that drives the anchoring and adjustment effect; that is, it is ultimately the metacognitive information provided by the similarity between people's SGAs and the EPAs that informs final responses given to anchoring items. Other metacognitive factors, like source credibility, are thought to influence the weight or importance people assign to their SGAs and EPAs when making anchoring judgments, especially when the similarity between these anchors

is low. For instance, people may place less importance on the credibility of the source that the EPA is believed to be derived from when the similarity between their initial estimate and the external anchor is high. However, when the similarity between these two anchors is low, people may seek additional information to inform their final responses, such as the credibility of the source of the EPA. In this latter case when SGA-EPA similarity is low, people may place greater importance on the EPA when they believe it comes from a highly credible source and therefore make this external anchor more representative in their final responses (e.g., exhibit less adjustment away from the EPA). However, people may rely more on their own SGAs when presented with an EPA that they believe to be derived from a source with low credibility and modify their final responses to be more reflective of their own internal anchors (e.g., exhibit more adjustment away from the EPA).

OVERVIEW OF EXPERIMENT

The purpose of the current experiment is to test the hypothesis that the similarity between people's SGAs and EPAs acts as important metacognitive information that affects final responses when making judgments in an anchoring task. Participants will be presented with two anchoring items inquiring about the distance a plane would travel were it to fly from one destination to another while making stops at several different locations along the way. Next, participants will be asked to consider the anchoring items and report their initial estimates (i.e., SGAs) before being presented with the EPAs for each item. In an effort to manipulate the similarity between participants' SGAs and EPAs, the EPAs for this experiment will be dynamically generated to reflect either high or low similarity to participants' reported SGA. Participants will be unaware of this SGA-EPA similarity manipulation. In addition, the EPAs will be presented to participants as having ostensibly derived from either a high credible source (e.g., a senior geography major) or low credible source (e.g., a senior fine arts major). After being presented with the comparative assessment, participants will be asked to report their final responses. Finally, participants will be asked to rate the degree of confidence they have in the accuracy of their final responses.

Outline of Predicted Results

From this experimental design, seven unique hypotheses drawn from a metacognitive perspective of anchoring and adjustment will be tested to determine how EPA, SGA-EPA similarity, and source credibility influence participants' final responses

and their reported confidence in the accuracy of their final responses within the anchoring paradigm.

Predictions for Final Responses

Prediction 1: Main effect of EPA. First, on the basis of several previous studies, I predict that EPAs will act to influence final responses across each of the two anchoring items. That is, it is expected that participants who are presented high EPAs will report larger final responses than participants presented with low EPAs. Therefore, a main effect of EPA is expected.

Prediction 2: Two-way interaction between EPA and SGA-EPA similarity. Second, I predict that the EPA will interact with SGA-EPA similarity to influence final responses. Specifically, when the EPA is high, I expect that high SGA-EPA similarity will lead to overall larger final responses than when SGA-EPA similarity is low. However, when the EPA is low, I expect that high SGA-EPA similarity will lead to overall smaller final responses than when SGA-EPA is low. Thus, a two-way interaction between EPA and SGA-EPA similarity is expected.

Prediction 3: Two-way interaction between EPA and source credibility. Third, I predict that the credibility of the source of the EPA will influence final responses. That is, when the EPA is high, high source credibility will lead to overall larger final responses than when source credibility is low. However, when the EPA is low, high source credibility will lead to overall smaller final responses than when the source credibility is low. Therefore, a two-way interaction between EPA and source credibility is expected.

Prediction 4: Three-way interaction between EPA, SGA-EPA similarity, and source credibility. Fourth, I predict that EPA, SGA-EPA similarity, and source

credibility will interact with one another to influence final responses. That is, when the EPA is high, high source credibility will generally lead to overall larger final responses than low source credibility. However, the difference in final responses between the high and low source credibility conditions will be smaller when SGA-EPA similarity is high than when SGA-EPA similarity is low. Conversely, when the EPA is low, high source credibility will generally lead to overall smaller final responses than low source credibility. However, the difference in final responses between the high and low source credibility conditions will be smaller when SGA-EPA similarity is high than when SGA-EPA similarity is low. In other words, this three-way interaction should break down into a two-way interaction between SGA-EPA similarity and source credibility when the EPA is high, as well as a two-way interaction between SGA-EPA similarity and source credibility when the EPA is low.

As described earlier, this specific prediction highlights the expectation that SGA-EPA similarity is believed to carry more weight in one's metacognitive reasoning, which is proposed to be the underlying the process involved in anchoring and adjustment. Given previous research on self-generated and externally-provided information (Mussweiler & Neumann, 2000; Wänke, Bless, & Biller, 1996), it seems reasonable to expect people to give more weight to information that is partially self-generated (i.e., SGA-EPA similarity) than other factors that are entirely externally-provided (e.g., EPA, source credibility) when people are rendering final responses to anchoring items. Therefore, a three-way interaction between EPA, SGA-EPA similarity, and source credibility is expected.

Predictions for Confidence in Final Responses

Prediction 5: Main effect of SGA-EPA similarity. Fifth, I predict that participants will report overall greater confidence in the accuracy of their final responses when SGA-EPA similarity is high but not when SGA-EPA similarity is low. Therefore, a main effect of SGA-EPA similarity is expected.

Prediction 6: Main effect of source credibility. Sixth, I predict that participants will report overall greater confidence in the accuracy of their final responses when source credibility is high but not when source credibility is low. Therefore, a main effect of source credibility is expected.

Prediction 7: Two-way interaction between SGA-EPA similarity and source credibility. Finally, I predict that SGA-EPA similarity and source credibility will interact to predict final responses, such that the participants will report the greatest amount of confidence in their final responses when both SGA-EPA similarity and source credibility are high but not when SGA-EPA similarity and source credibility are low. Therefore, a two-way interaction between SGA-EPA similarity and source credibility is expected.

METHOD

Participants

Two-hundred and fourteen participants enrolled in introductory psychology courses at Wake Forest University participated in the current experiment. All participants were recruited through the Psychology Department's electronic participant pool and received credit towards their research course requirements in exchange for voluntary participation.

Design

The current experiment employed a 2 (Source Credibility: high vs. low) $\times$ 2 (SGA-EPA Similarity: high vs. low) $\times$ 2 (EPA: high vs. low) $\times$ 2 (EPA item-order: high EPA item first vs. low EPA item first) mixed factorial design, with Source Credibility, SGA-EPA Similarity, and EPA item-order serving as between-subjects variables and EPA serving as a within-subjects variable. Participants' final responses estimating the value of each of the two the anchoring items were used as the dependent variables.

Procedure

Upon arrival to the laboratory, participants were greeted by a research assistant who provided them with a brief oral introduction to the experiment and obtained informed consent. The experiment was described to participants as being a study of basic judgment and decision making processes. Afterwards, each participant was escorted to a private cubicle equipped with a personal computer, where they remained for the entire duration of the experiment. All of the instructions and stimuli were presented using MediaLab v2006 Research Software, a professional computer-based research software

suite (Jarvis, 2006). The instructions were self-paced and advanced by participants pressing either the SPACE BAR or other equivalent response key.

Participants were randomly assigned to one of eight experimental conditions. These conditions varied from one another only with respect to the three between-subjects variables. However, the general experimental paradigm remained consistent across all eight conditions.

Upon beginning the experiment, participants were presented with instructions about the study and were led to believe that a recent survey was administrated to several hundred senior college students, of various majors, in attendance at universities all across the country. After reading these instructions, one of the anchoring questions was presented. This question asked participants to consider the distance a plane would travel if it were to fly from one location (i.e., Greensboro, NC) to another (i.e., Denver, CO; see Appendix A) while making several stops along the way. The order of the anchoring items was counterbalanced across conditions.

Self-Generated Anchor

For each anchoring item, participants were given 45 seconds to consider the item before being required to report an absolute estimate about the total distance traveled (in miles). Furthermore, participants were forced by the software to make an estimate that was more than 500 miles and less than 9,999 miles. This absolute estimate served as their SGA for this portion of the study.

SGA-EPA Similarity

In order to manipulate SGA-EPA Similarity in the high EPA condition, the SGAs provided by participants had either an additional 7% (high similarity condition) or 35%

(low similarity condition) of the SGA added to them. In the low EPA condition, participants' SGAs had either 7% or 35% of the SGA subtracted from them. These values were calculated by the software, without the participants' knowledge, and were subsequently used as the EPAs presented to participants.

Source Credibility

Coupled with each EPA was information about where the EPA originated. Specifically, participants were informed that a randomly selected college senior studying either fine arts (low source credibility condition) or geography (high source credibility condition) had responded to the anchoring item as part of the large-scale survey described earlier. Participants were informed that the source had estimated the total distance traveled to be the value of the EPA calculated earlier in the experiment (using the SGAs provided by participants).

Comparative Assessment and Final Responses

Consistent with many other anchoring studies, participants were asked to indicate whether they believed that the true distance traveled was more or less than the EPA provided by the college senior. Upon making their selection, participants were asked to generate a final absolute estimate concerning the total distance that the plane traveled from its point of departure to its destination.

Confidence in Final Responses

For each anchoring item, participants were asked to rate the degree of confidence they had in their final estimate of the distance the plane traveled using a seven-point scale, with 1 (*not confident at all*) and 7 (*extremely confident*) as the anchor labels.

Filler Task

The next part of the experiment presented participants with a series of different individual difference questionnaires (NFC; Cacioppo, Petty, Feinstein, & Jarvis, 1996; see Appendix B; NFCS; Webster & Kruglanski, 1994; see Appendix C; TIPI; Gosling, Rentfrow, & Swann, 2003; see Appendix D) which were intended to erase participants' short-term memory for the first anchoring item. The results of these questionnaires had no bearing on the results of this study and will therefore not be discussed further.

After responding to the battery of questionnaires, participants were presented with a second anchoring item similar in presentation to the first anchoring item. This item once again asked participants to consider the distance a plane would travel were it to travel from one location (i.e., Dallas, TX) to another (i.e., Atlanta, GA; see Appendix A) and make a specific number of stops along the way before reaching its final destination. However, this anchoring item referenced different geographical locations than the ones used in the first anchoring item presented earlier but maintained the same overall distance of the trip to the initial anchoring item. Subsequently, the same procedures used for the first anchoring item were employed.

Lastly, participants were asked to provide some basic demographic information about their age, gender, and major. In addition, they were asked some questions designed to assess their knowledge about geography and distance (see Appendix E). Participants were debriefed, thanked for their participation, and released from the experiment.

RESULTS

Preliminary Analyses

The data were analyzed using a 2 (Source Credibility: high vs. low) $\times$ 2 (SGA-EPA Similarity: high vs. low) $\times$ 2 (EPA: high vs. low) $\times$ 2 (EPA item-order: high EPA item first vs. low EPA item first) repeated-measures analysis of covariance (ANCOVA), with high EPAs and low EPAs used as covariates.

This analysis revealed no main effect for EPA item-order, $F(1, 203) = .002$, *ns*, demonstrating that participants' final responses did not differ as a result of the order that the anchors were presented. Thus, to simplify the results EPA item-order was removed from all subsequent analyses.

Final Responses

The final responses data were analyzed using a 2 (Source Credibility: high vs. low) $\times$ 2 (SGA-EPA Similarity: high vs. low) $\times$ 2 (EPA: high vs. low) repeated-measures analysis of covariance (ANCOVA), with high EPAs and low EPAs used as covariates.

Consistent with prediction 1, a main effect of EPA emerged, $F(1, 207) = 31.02$, $p < .001$, such that high EPAs were associated with greater final responses (adj. $M = 3,145$, $SE = 17.86$) than low EPAs (adj. $M = 2,316$, $SE = 17.74$). In addition, a significant main effect of SGA-EPA Similarity emerged, $F(1, 207) = 13.11$, $p < .001$, such that high SGA-EPA Similarity was associated with greater final responses (adj. $M = 2,776$, $SE = 36.80$) than low SGA-EPA Similarity (adj. $M = 2,685$, $SE = 36.12$). The analysis also revealed significant main effects of the high EPA covariate, $F(1, 207) = 6151.74$, $p < .001$, and the low EPA covariate, $F(1, 207) = 2691.62$, $p < .001$, such that greater final responses were

positively associated with each of the covariates. There was no main effect found for Source Credibility, $F(1, 207) = .32, ns$.

The main effects were qualified by two statistically significant two-way interactions. Consistent with predictions 2 and 3, these included a significant EPA $\times$ SGA-EPA Similarity, $F(1, 207) = 144.11, p < .001$, and a significant EPA $\times$ Source Credibility interaction, $F(1, 207) = 150.87, p < .001$. However, the SGA-EPA Similarity $\times$ Source Credibility interaction was not statistically significant, $F(1, 207) = .051, ns$.

Most importantly, consistent with prediction 4, these effects were qualified by the predicted three-way interaction, $F(1, 207) = 11.26, p < .001$. Specifically, when the EPA was high, high source credibility generally led to overall greater final responses when SGA-EPA similarity was high than when SGA-EPA similarity was low. However, the difference in final responses between the high and low source credibility conditions was found to be smaller when SGA-EPA similarity was high than when SGA-EPA similarity was low. Conversely, when the EPA was low, high source credibility generally led to overall smaller final responses when SGA-EPA similarity was high than when SGA-EPA similarity was low. However, the difference in final responses between the high and low source credibility conditions was found to be smaller when SGA-EPA similarity was than when SGA-EPA similarity was low.

The adjusted means analyzed by this test are displayed in Figure 1 for the high EPA data and Figure 2 for the low EPA data. This three-way interaction was driven by the fact that the SGA-EPA Similarity $\times$ Source Credibility relationships changed direction from the high EPA item to the low EPA item.

Among the high EPA data, a significant main effect of SGA-EPA Similarity emerged, $F(1, 209) = 63.82, p < .001$, such that high SGA-EPA Similarity (adj. $M = 3,285, SE = 25.47$) was associated with greater final responses than low SGA-EPA Similarity (adj. $M = 2,998, SE = 25.24$). Also, as expected, a significant main effect of Source Credibility emerged, $F(1, 209) = 92.50, p < .001$, such that high Source Credibility (adj. $M = 3,315, SE = 26.53$) was associated with greater final responses than low Source Credibility (adj. $M = 2,968, SE = 25.29$). Both of these main effects, however, were qualified by a significant SGA-EPA Similarity $\times$ Source Credibility interaction, $F(1, 209) = 5.06, p < .05$.

Four pair-wise contrasts were computed to examine the effects more closely among the high EPA data (Figure 1). As expected, when SGA-EPA Similarity was high, significantly larger final responses were reported when the EPA came from a high credible source, than when it came from a low credible source, $t(207) = 4.92, p < .001$. In addition, when SGA-EPA Similarity was low, significantly larger final responses were reported when the EPA came from a high credible source, than when it came from a low credible source, $t(207) = 8.16, p < .001$. Also consistent with expectations, when the EPA came from a high credible source, significantly larger final responses were reported when SGA-EPA Similarity was high, than when SGA-EPA Similarity was low, $t(207) = 3.29, p < .001$. In addition, when the EPA came from a low credible source, significantly larger final responses were reported when SGA-EPA Similarity was high than when SGA-EPA Similarity was low, $t(207) = 6.59, p < .001$.

A similar pattern of results was found for the low EPA data. As expected, a significant main effect of SGA-EPA Similarity emerged, $F(1, 208) = 134.78, p < .001$,

such that high SGA-EPA Similarity (adj. $M = 2,096$, $SE = 26.16$) was associated with smaller final responses than low SGA-EPA Similarity (adj. $M = 2,537$, $SE = 25.77$). In addition, a significant main effect of Source Credibility was also found, $F(1, 208) = 81.58$, $p < .001$, such that high Source Credibility (adj. $M = 2,156$, $SE = 25.24$) was associated with smaller final responses than low Source Credibility (adj. $M = 2,477$, $SE = 24.88$). However, both of these main effects were qualified by a significant SGA-EPA Similarity $\times$ Source Credibility interaction, $F(1, 208) = 7.32$, $p < .01$.

Similar to the follow-up tests conducted for the high EPA data, four pair-wise contrasts were computed for the low EPA data (see Figure 2). As expected, when SGA-EPA Similarity was high, significantly smaller final responses were reported when the EPA came from a high credible source, than when it came from a low credible source, $t(207) = -4.22$, $p < .001$. In addition, when SGA-EPA Similarity was low, significantly smaller final responses were reported when the EPA came from a high credible source, than when it came from a low credible source, $t(207) = -7.86$, $p < .001$. Also consistent with expectations, when the EPA came from a high credible source, significantly smaller final responses were reported when SGA-EPA Similarity was high, than when SGA-EPA Similarity was low, $t(207) = -6.50$, $p < .001$. In addition, when the EPA came from a low credible source, significantly smaller final responses were reported when SGA-EPA Similarity was high than when SGA-EPA Similarity was low, $t(207) = -10.14$, $p < .001$.¹

¹ It is worth noting that among the 2 conditions expected to differ the most in their final responses, high SGA-EPA Similarity and high Source Credibility when the EPA was high ($M = 3,406$, $SE = 37.61$) and high SGA-EPA Similarity and high Source Credibility when the EPA was low ($M = 1,984$, $SE = 37.37$), the difference was highly significant, $t(207) = 26.79$, $p < .001$. Also, consistent with the 2 conditions expected not to differ (or differ the least) in their final responses, low SGA-EPA Similarity and low Source Credibility when the EPA was high ($M = 2,799$, $SE = 35.62$) and low SGA-EPA

Figure 1

Means of participants' final responses by SGA-EPA similarity and source credibility for
high EPAs

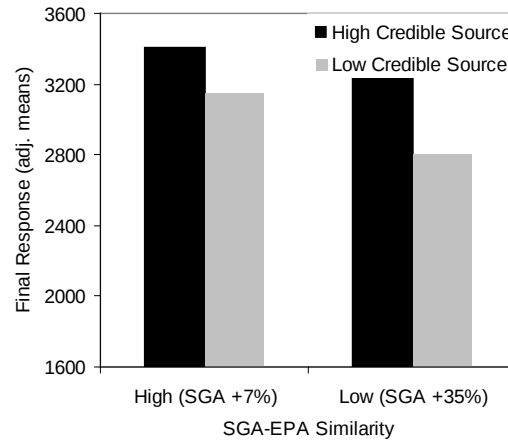
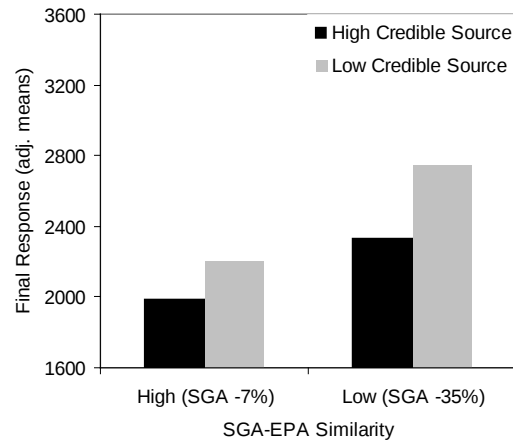


Figure 2

Means of participants' final responses by SGA-EPA similarity and source credibility for
low EPAs



Similarity and low Source Credibility when the EPA was low ($M = 2,746$, $SE = 35.44$), were the only conditions that did not differ significantly, $t(207) = 0.99$, ns .

Confidence in Final Responses

The confidence data were analyzed using a 2 (Source Credibility: high vs. low) $\times$ 2 (SGA-EPA Similarity: high vs. low) $\times$ 2 (EPA: high vs. low) repeated-measures analysis of variance (ANOVA). Consistent with prediction 5, a main effect of SGA-EPA Similarity emerged, $F(1, 210) = 9.11, p < .01$, such that high SGA-EPA Similarity ($M = 4.27, SD = 1.09$) was associated with greater confidence in final responses than low SGA-EPA Similarity ($M = 3.88, SD = 1.21$). Also, consistent with prediction 6, a main effect of Source Credibility emerged, $F(1, 210) = 99.54, p < .001$, such that high Source Credibility ($M = 4.71, SD = 1.02$) was associated with greater confidence in final responses than low Source Credibility ($M = 3.44, SD = 1.28$). However, there was no main effect of EPA, $F(1, 210) = .162, ns$.

Consistent with prediction 7, the main effects were qualified by a statistically significant SGA-EPA Similarity $\times$ Source Credibility interaction, $F(1, 210) = 35.30, p < .001$. Neither the SGA-EPA Similarity $\times$ EPA, $F(1, 210) = 2.24, ns$, nor the Source Credibility $\times$ EPA interactions reached statistical significance, $F(1, 210) = 2.24, ns$. However, the main effects and two-way interaction were qualified by an unexpected three-way interaction, $F(1, 210) = 8.96, p < .01$. The means analyzed by this test are displayed in Figure 3 for the high EPA data and Figure 4 for the low EPA data.

Among the high EPA data, a significant main effect of SGA-EPA Similarity emerged, $F(1, 210) = 11.85, p < .01$, such that high SGA-EPA Similarity was associated with greater confidence in final responses ($M = 4.36, SD = 1.12$) than low SGA-EPA Similarity ($M = 3.83, SD = 1.11$). Additionally, a significant main effect of Source Credibility also emerged, $F(1, 210) = 85.56, p < .001$, such that high Source Credibility

($M = 4.80$, $SD = 1.12$) was associated with greater confidence in final responses than low Source Credibility ($M = 3.39$, $SD = 1.11$). Both of these main effects, however, were qualified by a significant SGA-EPA Similarity $\times$ Source Credibility interaction, $F(1, 210) = 5.23$, $p < .05$.

Four pair-wise contrasts were computed to examine the effects more closely among the high EPA data (see Figure 3). As expected, when SGA-EPA Similarity was high, significantly greater confidence in final responses was reported when the EPA came from a high credible, than when it came from a low credible source, $t(210) = 10.13$, $p < .001$. In addition, when SGA-EPA Similarity was low, significantly greater confidence in final responses was reported when the EPA came from a high credible source, than when it came from a low credible source, $t(210) = 5.04$, $p < .001$. Also consistent with expectations, when the EPA came from a high credible source, significantly greater confidence in final responses was reported when SGA-EPA Similarity was high, than when SGA-EPA Similarity was low, $t(210) = 5.37$, $p < .001$. However, when the EPA came from a low credible source, there was no significant difference in reported confidence in final responses between high SGA-EPA Similarity and low SGA-EPA Similarity, $t(210) = 0.27$, *ns*.

The general pattern of results found for the low EPA data was similar to that of the high EPA data. A significant main effect of Source Credibility emerged, $F(1, 210) = 47.31$, $p < .001$, such that high Source Credibility ($M = 4.36$, $SD = 1.22$) was associated with greater confidence in final responses than low Source Credibility ($M = 3.49$, $SD = 1.21$). There was no main effect for SGA-EPA Similarity. However, the main effect was

qualified by a significant SGA-EPA Similarity $\times$ Source Credibility interaction, $F(1, 210) = 6.61, p < .05$ (see Figure 4).

Similar to the follow-up tests conducted for the high EPA data, four pair-wise contrasts were computed for the low EPA data. As expected, when SGA-EPA Similarity was high, significantly greater confidence in final responses was reported when the EPA came from a high credible source, than when it came from a low credible source, $t(210) = 11.65, p < .001$. However, when SGA-EPA Similarity was low, there was no significant difference in reported confidence in final responses when the EPA came from a high credible source or low credible source, $t(210) = 0.48, ns$. Also consistent with expectations, when the EPA came from a high credible source, significantly greater confidence in final responses was reported when SGA-EPA Similarity was high, than when SGA-EPA Similarity was low, $t(210) = 6.89, p < .001$. Unexpectedly, when the EPA came from a low credible source, significantly greater confidence in final responses was reported when SGA-EPA Similarity was low, than when SGA-EPA Similarity was high, $t(210) = 4.28, p < .001$.²

² It is worth noting that participants' ratings of confidence in their final responses were found to be greatest in the expected conditions across the high and low EPA items. When the EPA was high, a planned contrast showed that confidence among participants in the high SGA-EPA Similarity/high Source Credibility condition ($M = 5.30, SD = .89$) was greater than all other participants ($M = 3.69, SD = 1.18$), $t(210) = 10.59, p < .001$. Likewise, when the EPA was low, a planned contrast showed that confidence among participants in the high SGA-EPA Similarity and high Source Credibility condition ($M = 5.26, SD = .96$) was greater than all other conditions ($M = 3.65, SD = 1.27$), $t(210) = 10.58, p < .001$.

Figure 3

Means of participants' confidence ratings in their final responses by SGA-EPA similarity
and source credibility for high EPAs

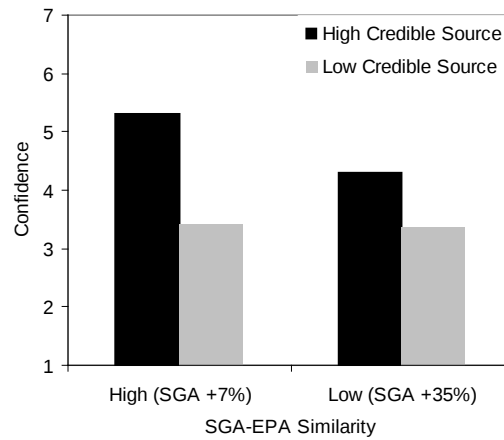
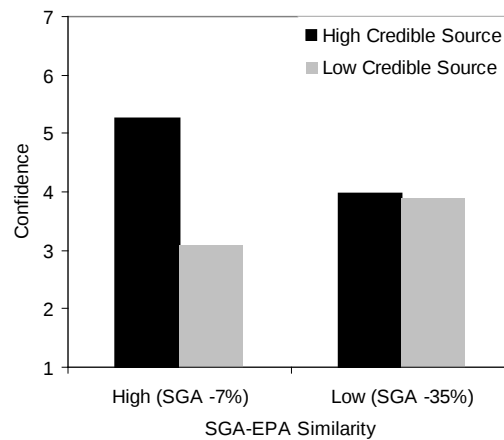


Figure 4

Means of participants' confidence ratings in their final responses by SGA-EPA similarity
and source credibility for low EPAs



DISCUSSION

The data from the current study provide important groundwork for a metacognitive process account of the anchoring and adjustment heuristic. Specifically, the current findings suggest that when people encounter the classic anchoring item (paired with a comparative assessment), they generate an initial estimate (e.g., SGA) and compare its similarity to an external anchor provided by the environment (e.g., EPA). The data also suggest that people actively thinking about and reevaluate their SGA in light of the information provided by the similarity between their SGA and the EPA. Thus, when people use this similarity information to generate a final response to an anchoring item under consideration, it serves as evidence that they have thought about an earlier cognition (i.e., SGA) in light of new information (i.e., EPA). Such a process, by definition, is metacognitive (Jost et al., 1998; Petty et al., 2002). Additional support for a metacognitive view of anchoring and adjustment was provided by evidence showing that the credibility of the source of the EPA interacts with the EPA and SGA-EPA similarity to influence final responses. That is, the effects of the EPA were weighted by the source of the EPA. Consistent with the metacognitive framework described earlier, this evidence clearly suggests that an EPA, and its similarity to an SGA, has the greatest impact on final responses when the credibility of the source of the EPA is relatively high.

Summary of Findings

The current experiment tested seven hypotheses which are important for establishing the validity of the proposed metacognitive process account for the anchoring and adjustment heuristic. First, consistent with several previous studies (Chapman &

Johnson, 2002; Jacowitz & Kahneman, 1995; Tversky & Kahneman, 1974), it was predicted that EPAs would operate to influence participants' final responses (see prediction 1). The data confirmed this prediction.

Second, it was predicted that the EPA would interact with SGA-EPA similarity and these two factors would influence participants' final responses (see prediction 2) . The confirmation of this prediction suggests that the similarity between their SGA and the EPA acts as relevant metacognitive information, which is used by participants to reevaluate their initial estimates and inform their final responses.

Third, it was predicted that the EPA would interact with the credibility of the source of the EPA and these two factors would influence participants' final responses (see prediction 3) The confirmation of this prediction suggests that participants actively evaluated the credibility of the source that they believed the EPA to be derived from and subsequently used this information to render their final responses. This further suggests that people evaluate their SGA in light of information about the EPA.

Fourth, it was predicted that the EPA, SGA-EPA similarity, and source credibility would interact with one another to predict participants' final responses (see prediction 4). The confirmation of this prediction provides evidence in support of the notion that people give the similarity between their SGA and the EPA more weight than external factors, such as source credibility, when composing final responses to anchoring items and suggests that the three factors of EPA, SGA-EPA similarity, and source credibility operate together to predict final responses. The overall pattern of data from the three-way interaction, and the two two-way interactions that cause it, are consistent with what

one would expect if peoples' SGAs are evaluated in light of the EPA (using a similarity mechanism) and source credibility through a metacognitive fashion.

Fifth, it was predicted that participants would report overall greater confidence in their final responses when SGA-EPA similarity was high but not when it was low (see prediction 5). Sixth, it was predicted that participants would report overall greater confidence in their final responses when source credibility was high but not when it was low (see prediction 6). Finally, it was predicted that SGA-EPA similarity and source credibility would interact to predict participants' ratings of confidence in their final response (see prediction 7). All of these predictions were confirmed by the data and further support a metacognitive perspective of anchoring and adjustment. By definition, thought confidence is a metacognitive factor (Jost et al., 1998; Petty et al., 2002) because assigning a rating of confidence to a particular thought requires an individual to actively think about and evaluate that thought in light of information which informs their confidence judgment. In the case of the anchoring and adjustment heuristic, people appear to be thinking about and reevaluating the correctness of their SGA in light of the metacognitive information provided by the EPA, the degree of SGA-EPA similarity, and the credibility of the source of the EPA.

Implications for the Anchoring and Adjustment Heuristic

The present findings compliment the conclusion of previous anchoring studies (Epley & Gilovich, 2001, 2004, 2005, 2006), which have found people's SGAs to be important for the anchoring effect. Specifically, the data suggests that SGAs appear to activate and moderate processes of adjustment. In addition, it appears that people are not necessarily engaged in biased thinking, where the EPA exerts a mindless influence on the

estimates they give within the anchoring paradigm. Rather, evidence from the current study suggests that people are actually thinking reasonably well about the available information they generate and that is externally-provided. That is, factoring in the EPA and the source of the EPA to render a final response is conceptually similar to factoring in or out relevant or irrelevant consensus data. Doing so would seem to be a reasonable and relatively mindful thing to do (Gigerenzer, 2008).

However, these early studies are limited in at least three ways. First, although previous research on the anchoring effect has successfully demonstrated that SGAs play an important role in the anchoring and adjustment process, they have failed to actually measure the SGAs participants construct when first presented with an anchoring item. Typically, these early studies assumed that specific SGAs were being generated by participants. It was thought, for example, that 1776 may be an SGA for one's estimate of the year that George Washington became president of the United States. By explicitly asking participants in the current experiment to report their SGAs before being presented with the EPA, their SGAs could be assessed and compared against their final responses. The inclusion of this request also permitted the manipulation of SGA-EPA similarity.

Second, previous research (e.g., Tversky & Kahneman, 1974) investigating the anchoring and adjustment effect has not gone so far as to test a process account for this heuristic drawn from a metacognitive perspective. While the data from other studies (e.g., Epley & Gilovich, 2001, 2004, 2005, 2006) have provided strong evidence that SGAs are important for the estimation process inherent to the anchoring and adjustment heuristic, they do not address hypotheses drawn from a basic metacognitive account of anchoring. The current study extends this earlier research by suggesting that SGA-EPA

similarity can serve as important metacognitive information that influences the amount of adjustment away from the EPA, and which consequently acts as a determining factor in the final responses that people generate.

Finally, unlike previous studies (e.g., see Chapman & Johnson, 2002; Epley & Gilovich, 2001, 2004, 2005, 2006; Mussweiler & Strack, 1999; Strack & Mussweiler, 1997), which considered SGAs and EPAs separately across different experiments, the current study was designed to investigate the moderating role of SGA-EPA similarity (as well as source credibility). Such an examination appears to be impossible using an experimental design that does not directly measure participants' SGAs. Investigating the moderating role of SGA-EPA similarity is essential for pushing the anchoring literature forward. Past research (Chapman & Johnson, 2002) has suggested that people appear to use the information provided by both types of anchors when generating final responses about anchoring items. The data reported in the current study suggests that this interaction is especially important to the magnitude of the anchoring and adjustment effect.

One potential reaction to the proposed metacognitive model and current experiment is that SGAs are not spontaneously generated, but only become salient when people are directly asked to report them. Another potential reaction involves the possibility that requesting people to report their SGAs, alone, has an effect on their final responses. However, these potential criticisms were addressed by the results of two pilot studies. In fact, a pilot study, designed to test the hypothesis that SGAs are spontaneously generated, was conducted before the current experiment. Specifically, this hypothesis was tested by comparing the SGAs of participants who reported their SGAs

before being presented with an EPA with those of participants who were asked to recall their SGAs after being presented with an EPA and reporting their final responses. Results from this pilot study showed conclusively that the SGAs among participants across both conditions, among the same items used in the current experiment (i.e., total distance traveled by three flights), did not differ. These findings suggest that SGAs are spontaneously generated and influence final responses even when they are not explicitly requested.

Furthermore, in a second pilot study, the final responses of participants who were asked to provide an SGA with participants who were not did not differ in their final responses on any of the 12 anchoring items that were administered. This finding suggests that requesting people to express their SGA does not influence their final responses.

Not only do these pilot studies support the direct measurement of SGAs, but they provide additional support for the notion that SGAs are spontaneously generated and that a metacognitive process underlies the operation of the anchoring and adjustment effect. Specifically, people appear to be able to recall their SGAs, even after reporting a final response that is influenced by other metacognitive information and adjusted from their initial estimate.

Limitations

Several unique limitations are present in the design of the current study that should be addressed by future research. For instance, only one kind of anchoring item was used across all of the experimental conditions in this study. While this item is conceptually very similar to other anchoring items used in previous research, it differs to the extent that it requires participants to estimate distances that they may be somewhat

familiar with because of their geographical location; that is, the participants in the current study may have considerably more accurate initial estimates of this anchoring item than participants living in a different geographical region of the country. While this limitation is unlikely to significantly affect the findings reported by the present research, future studies should assess SGA-EPA similarity, ratings of confidence, and other relevant external factors, like source credibility, using a variety of different anchoring items. Similar findings using other anchoring items would ultimately enhance how well the metacognitive model generalizes to other types of anchoring situations.

Another limitation present in the current research involves the use of source credibility by using only one pairing of high and low credible sources. That is, source credibility was employed as a between-subjects factor, being held constant for both anchoring items. It would be important for future research to test the interaction of SGA-EPA similarity and source credibility and their influence on final responses using other high and low credible source pairings.

Finally, a third limitation concerns the use of high and low EPAs as covariates in the analysis of final responses. One criticism of this methodology is that the inclusion of high and low EPAs as covariates may have biased our findings because the EPAs are likely to covary, systematically, with SGA-EPA similarity. An alternative to using high and low EPAs as covariates would be to use high and low SGAs as the covariates, which should not covary systematically with SGA-EPA similarity. Future research might examine the influence of SGA-EPA similarity and source credibility on final responses given within the anchoring paradigm using high and low SGAs as covariates.

It should be clear that the final decision to include high and low EPAs as covariates in the current research was made for several reasons. First, the inclusion of high and low EPAs as the covariates for this study provides a more conservative test. That is, although EPAs and EPA-SGA similarity covaried, they covaried in ways counter to the predictions. In fact, when similarity was low for the high EPA item, and when similarity was high for the low EPA item, these participants received the largest EPAs (i.e., +35% and -7% of their SGAs respectively, for their respective items). Given the strong correlation between EPA and final response, one would expect under these conditions to find the largest final responses. Yet, the smallest final responses were found under these conditions.

Second, it is worth noting that the SGAs and the EPAs were perfectly correlated with one another. This suggests that the use of high and low EPAs as the covariates also takes into account the influence SGAs have on final responses.

Finally, given that EPAs (with relevant credibility information) were presented after participants had reported their SGAs, the inclusion of high and low EPAs as covariates was expected to reduce more error in the measurement of participants' final responses than would SGAs. This reduction of error in final responses provided a clearer test of the effects that source credibility and SGA-EPA similarity have on the final responses rendered by the participants.

Future Directions

While the current study has shed some light on issues previously ignored by the anchoring literature, there are many questions that remain to be answered. First, the data reported here demonstrated that the metacognitively relevant information provided by the

external factor of source credibility was used by participants to reevaluate their initial estimate and subsequently influence their final responses. It seems likely, given this finding, that other external factors also influence final responses to anchoring items. For example, the amount of detail or information that justifies the value of the EPA may provide metacognitively relevant information. Consider a medical patient who is trying to determine if she should undergo a risky medical procedure. In order to avert physical complications in the future, she consults research detailing the percentage of successful similar procedures conducted in the past. In this particular case, the percentage would act as the EPA. The value of the EPA would likely have a greater influence on the patient's final decision regarding whether or not she should undergo the medical procedure if the report provided a wealth of details. This is because a greater amount of detail about the EPA may offer metacognitively relevant information that adds additional justification and support for its validity. In contrast, a dearth of details should reduce the influence of the EPA as reflected in the patient's final decision. While other external factors, other than source credibility, were not considered in the current experiment, their possible influence on anchoring judgments certainly raises questions for future research.

Another potential direction for future research, relevant to the model endorsed here, concerns how exactly people use SGA-EPA similarity to render final responses. One possibility not tested in the current experiment is that people simply average the values of their SGA and the EPA. It could be that regardless of whether people conclude that their SGA and the EPA have high or low similarity, they retain their initial SGA and average it with the EPA to produce a final response. The degree of adjustment away from the EPA would still be governed by the SGA-EPA similarity mechanism but an

averaging procedure would be responsible for generating the actual final response.

Previous research has suggested that people may render their final responses by selecting the value that falls between their initial estimate and the midpoint of their range of plausible values after assessing the EPA (Parducci, 1974). However, it should be clear that if people do render their final responses to anchoring problems as the midpoint between their SGA and the EPA it would not rule out the role of metacognitive processing.

Finally, this unique perspective of anchoring and adjusting warrants further investigation. Subsequent studies may further this line of work by borrowing from recent models of metacognition (e.g., Petty & Briñol, 2008; Petty, Briñol, & DeMarree, 2007). For example, investigating whether or not the effects shown here are augmented among high need for cognition individuals, conditions of high cognitive elaboration, or high EPA-argument quality are three cases whereby one might expect to find greater degrees of metacognitive processing may prove to be fruitful for future research.

Conclusion

In conclusion, the present research was designed to test a metacognitive process account for the anchoring and adjustment heuristic. Direct manipulations of EPA, SGA-EPA similarity, and EPA source credibility in the current experiment provided a direct test of seven hypotheses drawn from a metacognitive perspective of the anchoring and adjustment heuristic. The data suggest that anchoring and adjustment can occur through a metacognitive process that involves consciously evaluating and reevaluating one's SGA in light of an EPA, while also considering the implications of other external factors (e.g., source credibility of the EPA). These results, combined with the reported pilot study

data, suggest that SGAs are generated spontaneously and that a metacognitive process underlies the operation of the anchoring and adjustment effect.

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APPENDIX A

The two anchoring items used across the two parts of the study (in order of presentation)

If a plane leaves from Greensboro, NC and flies to New York, NY, then flies directly from New York, NY to Detroit, MI, and then flies directly from Detroit, MI to Denver, CO, what is the total distance (in miles) that the plane has traveled?

If a plane leaves from Dallas, TX and flies directly to Buffalo, NY, then flies from Buffalo, NY to Indianapolis, IN, and then flies directly from Indianapolis, IN to Atlanta, GA, what is the total distance (in miles) that the plane has traveled?

APPENDIX B

Need for Cognition Scale (NFC)

Instructions: For each of the statements below, please indicate to what extent the statement is characteristic of you. Please use the following scale:

1=extremely uncharacteristic of you

2=somewhat uncharacteristic

3=uncertain

4=somewhat characteristic

5=extremely characteristic of you

1. I would prefer complex to simple problems.
2. I like to have the responsibility of handling a situation that requires a lot of thinking.
3. Thinking is not my idea of fun.
4. I would rather do something that requires little thought than something that is sure to challenge my thinking abilities.
5. I try to anticipate and avoid situations where there is a likely chance I will have to think in depth about something.
6. I find satisfaction in deliberating hard and for long hours.
7. I only think as hard as I have to.
8. I prefer to think about small, daily projects than long-term ones.
9. I like tasks that require little thought once I've learned them.
10. The idea of relying on thought to make my way to the top appeals to me.

11. I really enjoy a task that involves coming up with new solutions to problems.
12. Learning new ways to think doesn't excite me very much.
13. I prefer my life to be filled with puzzles that I must solve.
14. The notion of thinking abstractly is appealing to me.
15. I would prefer a task that is intellectual, difficult, and important to one that is somewhat important but does not require much thought.
16. I feel relief rather than satisfaction after completing a task that required a lot of mental effort.
17. It's enough for me that something gets the job done; I don't care how or why it works.
18. I usually end up deliberating about issues even when they do not affect me personally.

APPENDIX C

Need for Closure Scale (NFCS)

Instructions: Read each of the following statements and decide how much you agree with each according to your beliefs and experiences. Please respond according to the following scale:

1=strongly disagree

2=moderately disagree

3=slightly disagree

4=slightly agree

5=moderately disagree

6=strongly disagree

1. I think that having clear rules and order at work is essential for success.
2. Even after I've made up my mind about something, I am always eager to consider a different opinion.
3. I don't like situations that are uncertain.
4. I dislike questions which could be answered in many different ways.
5. I like to have friends who are unpredictable.
6. I find that a well ordered life with regular hours suits my temperament.
7. I enjoy the uncertainty of going into a new situation without knowing what might happen.

8. When dining out, I like to go to places where I have been before so that I know what to expect.
9. I feel uncomfortable when I don't understand the reason why an event occurred in my life.
10. I feel irritated when one person disagrees with what everyone else in a group believes.
11. I hate to change my plans at the last minute.
12. I would describe myself as indecisive.
13. When I go shopping, I have difficulty deciding exactly what it is I want.
14. When faced with a problem I usually see the one best solution very quickly.
15. When I am confused about an important issue, I feel very upset.
16. I tend to put off making important decisions until the last possible moment.
17. I usually make important decisions quickly and confidently.
18. I have never been late for an appointment or work.
19. I think it is fun to change my plans at the last moment.
20. My personal space is usually messy and disorganized.
21. In most social conflicts, I can easily see which side is right and which is wrong.
22. I have never known someone I did not like.
23. I tend to struggle with most decisions.
24. I believe orderliness and organization are among the most important characteristics of good student.
25. When considering most conflict situations, I can usually see how both sides could be right.

26. I don't like to be with people who are capable of unexpected actions.
27. I prefer to socialize with familiar friends because I know what to expect from them.
28. I think that I would learn best in a class that lacks clearly stated objectives and requirements.
29. When thinking about a problem, I consider as many different opinions on the issue as possible.
30. I don't like to go into a situation without knowing what I can expect from it.
31. I like to know what people are thinking all the time.
32. I dislike it when a person's statement could mean many different things.
33. It's annoying to listen to someone who cannot seem to make up his or her mind.
34. I find that establishing a consistent routine enables me to enjoy life more.
35. I enjoy having a clear and structured mode of life.
36. I prefer interacting with people whose opinions are very different from my own.
37. I like to have a plan for everything and a place for everything.
38. I feel uncomfortable when someone's meaning or intention is unclear to me.
39. I believe that one should never engage in leisure activities.
40. When trying to solve a problem I often see so many possible options that it's confusing.
41. I always see many possible solutions to problems I face.
42. I'd rather know bad news than stay in a state of uncertainty.
43. I feel that there is no such thing as an honest mistake.
44. I do not usually consult many different options before forming my own view.
45. I dislike unpredictable situations.

46. I have never hurt another person's feelings.

47. I dislike the routine aspects of my work.

APPENDIX D

Ten-Item Personality Inventory (TIPI)

Instructions: Here are a number of personality traits that may or may not apply to you. Please write a number next to each statement to indicate the extent to which you agree or disagree with that statement. You should rate the extent to which the pair of traits applies to you, even if one characteristic applies more strongly than the other.

1=disagree strongly

2=disagree moderately

3=disagree a little

4=neither agree nor disagree

5=agree a little

6=agree moderately

7=agree strongly

I see myself as:

1. Extraverted, enthusiastic.
2. Critical, quarrelsome.
3. Dependable, self-disciplined.
4. Anxious, easily upset.
5. Open to new experiences, complex.
6. Reserved, quiet.
7. Sympathetic, warm.

8. Disorganized, careless.
9. Calm, emotionally stable.
10. Conventional, uncreative.

APPENDIX E

Demographic questions presented at conclusion of the study

1. What is your age?
2. What is your gender?
3. What year are you in school?
4. What is your major?
5. How knowledgeable do you feel that you are about geography and distance?

SCHOLASTIC VITA

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Petrocelli, J., & Dowd, K. (in press). Ease of counterfactual thought generation moderates the relationship between need for cognition and punitive responses to crime. *Personality and Social Psychology Bulletin*.

Punitive responses to crime have been linked to a relatively low need for cognition (NFC). Sargent's (2004) findings suggested that this relationship is due to a relatively complex attributional system, employed by high NFC individuals, which permits them to recognize potential external or situational causes of crime. However, high NFC individuals may also be more likely to engage in counterfactual thinking, which has been linked to greater judgments of blame and responsibility. Three studies examine the relationship between trait and state NFC and punitiveness in light of counterfactual thinking. Results suggest that the ease of generating upward counterfactuals in response to an unfortunate crime moderates the NFC-punitiveness relationship, such that high NFC individuals are less punitive than low NFC individuals, but only when counterfactual thoughts are relatively difficult to generate. These findings are discussed in light of punishment theory and their possible implications with regard to the legal system.

Davis, J., & Dowd, K. (2008). *The Bethesda Model: Providing a new day for North Carolina's suspended youth*. [Electronic version]. North Carolina Governor's Crime Commission, North Carolina Criminal Justice Analysis Center. Retrieved January 26, 2009 from <http://www.ncgccd.org/pdfs/pubs/bethesda.pdf>

Yearwood, D., Dowd, K., & Staroneck, L. (2008). Exploring alternatives for improving child support application filing rates within the context of civil protection order cases. *Children and Youth Services Review*, 30, 821-833.

The importance of obtaining child support for victims of domestic violence has been well documented in the literature yet little systematic and empirical research has been conducted on how often victims apply for and receive this type of assistance and on how the number of child support filings can be increased among victims of domestic violence. This paper presents findings from a quasi-experimental study which tested two strategies for improving the rate at which individuals filing civil protection orders also file for child support. Informational packets, outlining the process and procedure for filing for child support, and follow-up phone calls were made available to victims applying for relief under a civil protection order. Comparisons between study and control sites, during both baseline and study periods, indicate mixed or inconclusive results for the use of informational packets with the efficacy of follow-up phone calls remaining untested. Numerous explanations are provided for these findings with accompanying policy recommendations being offered in an effort to overcome

study limitations and to educate members of the judicial system on the importance of providing child support for victims of domestic violence.

McElroy, T., & Dowd, K. (2007). Action-orientation, consistency, and feelings of regret. *Journal of Judgment and Decision-making*, 2(6), 333-341.

Previous research has demonstrated that consistency between people's behavior and their dispositions has predictive validity for judgments of regret. Research has also shown that differences in the personality variable of action orientation can influence ability to regulate negative affect. The present set of studies was designed to investigate how both consistency factors and action-state personality orientation influence judgments of regret. In Study 1, we used a recalled life event to provide a situation in which the person had experienced either an action or inaction. Individuals with an action orientation experienced more regret for situations involving inaction (staying home) than situations involving action (going out). State-oriented individuals, however, maintained high levels of regret and did not differ in their regret ratings across either the action or inaction situations. In Study 2, participants made realistic choices involving either an action or inaction. Our findings revealed the same pattern of results: action-oriented individuals who chose an option that involved not acting (inaction) had more regret than individuals who chose an option that involved acting (action). State-oriented individuals experienced high levels of regret regardless of whether they chose to act or not to act.

McElroy, T., & Dowd, K. (2007). Susceptibility to anchoring effects: How openness-to-experience influences responses to anchoring cues. *Journal of Judgment and Decision-making*, 2(1), 48-53.

Previous research on anchoring has shown this heuristic to be a very robust psychological phenomenon ubiquitous across many domains of human judgment and decision-making. Despite the prevalence of anchoring effects, researchers have only recently begun to investigate the underlying factors responsible for how and in what ways a person is susceptible to them. This paper examines how one such factor, the Big-Five personality trait of openness-to-experience, influences the effect of previously presented anchors on participants' judgments. Our findings indicate that participants high in openness-to-experience were significantly more influenced by anchoring cues relative to participants low in this trait. These findings were consistent across two different types of anchoring tasks providing convergent evidence for our hypothesis.

Hayes, R., Dowd, K., & Collins, E. (2007). *The new North Carolinians: Doing justice for all in the criminal justice system*. [Electronic version]. North Carolina Governor's Crime Commission, North Carolina Criminal Justice Analysis Center. Retrieved January 2nd, 2007 from http://www.ncgccd.org/pdfs/pubs/hispanic_study.pdf